PDR 5/13/92

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON NUCLEAR WASTE
WASHINGTON, D.C. 20555

October 8, 1991

MEMORANDUM FOR: John C. Hoyle
Advisory Committee Management Officer

FROM: Raymond F. Fraley, Executive Director

SUBJECT: QUARTERLY REPORT ON CLOSED MEETINGS OF THE ADVISORY COMMITTEE ON NUCLEAR WASTE

In accordance with 10 CFR Part 7.17(b)(c), "Reports Required for Advisory Committees," this is to advise you that the Advisory Committee on Nuclear Waste held the following meetings since our last quarterly report on July 10, 1991.

Full Committee Meetings	Meeting Dates
33rd	July 25-26, 1991
34th	August 27-29, 1991
35th	September 27, 1991

Working Group Meeting	Meeting Date
Review of Regulatory Guides for Implementing Revisions to 10 CFR Part 20	September 23-24, 1991

A portion of the 34th meeting was closed to discuss matters that pertain to the Office of Government Ethics' proposed rule on ethical conduct of employees of the Executive Branch and the impact it will have on the personal and professional (non-government) activities of Committee members as well as its impact on the functioning of the Committee. This portion was closed to discuss information the release of which would represent a clearly unwarranted invasion of personal privacy [5 U.S.C. 552b(c)(6)].

Copies of this report will be filed with the NRC Public Document Room and the Library of Congress for public inspection and use.

Raymond F. Fraley
Executive Director

cc: M. Nordlinger, OGC

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for natural resources, which spanned six orders of magnitude. One could argue the usefulness of such a result to prioritization.

Dr. Judd began to discuss the actual elicitation process for the panel of twenty, which consisted of two ballots and computer/spreadsheet feedback. This was not anonymous, and rationales as well as probability estimates were projected through a computer onto a screen. Dr. Steindler queried whether a third ballot was taken to see if there were any further tendencies to change decisions. Dr. Judd indicated that this was done on the complex geology volcanism PC, but the overall aggregate didn't vary significantly. The panel decided consensus by taking the geometric mean (nth root of the product of n numbers) of the probabilities. The geometric mean was used to reduce the effect of large numbers domination (the geometric mean is smaller than the arithmetic average). An arbitrary zero was defined to be 10^{-6} to avoid zero probabilities introduced by one or two panel members. The on-line computer's capability permitted on-the-spot sensitivity analyses .

Dr. Judd summarized the lessons learned:

1. Panel preparation prior to assessment workshops (there were three) was essential.
2. Offsite workshops provided greater focus without interruptions.
3. A facilitator (decision analyst) was critical for keeping pace, focus and summarizing main points for record keeping.
4. On-line computer sensitivity analysis capability increased productivity and aided in setting importance and priorities - instantaneous feedback.
5. These types of assessments take time.
6. Pleasant environment improved quality and motivation.

Dr. Pomeroy began the question period by asking Dr. Judd whether the experts themselves decided on their own competence on any given issue. Dr. Judd indicated that the ballots provided this option. In response to Dr. Pomeroy's question on the dependence of the results on the elicitation method used, Dr. Judd noted the difference in the reliance on anonymity with the NUREG-1150 elicitation. In response to Dr. Steindler's question on different protocols for elicitations -- use only generalists, normative experts are not used for expert selection, etc. -- and their acceptability, Dr. Judd indicated that the protocol should be dictated by the occasion and specific conditions -- there is no uniformly fixed correct protocol. Dr. Steindler was curious about the particular chosen protocol's ability to withstand a test of intellectual assault at some future licensing hearing; Dr. Judd maintained that DOE's testing priority protocol for

using expert judgment was not so atypical or controversial vis-a-vis any other expert judgment protocol.

Dr. Abramson (NRC/res) noted that aggregated estimates tended to be more accurate than single expert opinions. This has repeatedly been substantiated in elicitation training tests using "almanac-type" questions. Dr. Abramson also recounted to the participants the past track record of expert elicitation; such as the use of anonymity, providing rationale without the actual estimate, etc. as used in the delphi method; as a type of method validation. Dr. Judd referenced a paper from Management Science by D. Bunn and G. Wright, "Interaction of Judgmental and Statistical Forecasting Method: Issues and Analysis" (Provided to the Committee). He noted that the abstract claims a higher level of quality for expert judgment than has been previously asserted.

K. Coppersmith, Geomatrix, Inc.

Dr. Coppersmith discussed the EPRI HLW technology program. This technology planning program is motivated by the utilities. The utilities are concerned that the site characterization program has prolonged data collection which would not be factored into decisions for 10 or 15 years. The utilities would like to have earlier "pinch points" for deciding on site suitability in the range of two or three years. The utilities also wanted to focus on what is important vis-a-vis consequences in terms of test priorities and field data collection; this was suggested as a way to clear the impasse on some of the major technical stumbling blocks; e.g., volcanism and co-seismic water table change. Performance assessment of the repository as a whole, in light of these technical impasse issues, might assist in prioritizing efforts.

So EPRI and member utilities commissioned an integrated PA effort to look at the external elements of the repository system (climate change, earthquakes, volcanism) and the effects on the subsurface conditions (groundwater flow). The goal was to be able to assess the barrier system performance and to finally compare radionuclide release to the EPA criteria probabilistically.

The short term goal was to determine site suitability of YM. In the long term this effort provides a capability to do real-time assessment of the site's performance, as more data and information becomes available. EPRI's approach was to assemble a team of one expert per technological area (Methodology Development Team); each expert was to develop the best model for that area and to provide for a reasonable estimate for uncertainty. EPRI will conduct workshops and expert elicitations to help quantify

the uncertainties in this process/model. The focus is to quantify uncertainty, and expert judgment appears to do this. The mechanisms for explicit expert elicitation provides these qualities needed for handling uncertainties -- it is adjudicable, probative, defensible and requires documentation.

In response to Dr. Steindler's question on real world validation of the EPRI model, Dr. Coppersmith indicated that some calibration had been done but that overall real world validation was difficult. In response to Dr. Hinze's question on the progress of YM site characterization for profitable use in EPRI's efforts, Dr. Coppersmith indicated that there was sufficient characterization for a first pass, which may provide enough feedback to help focus the testing and other site characterization. Dr. Coppersmith acknowledged Dr. Hinze's concern that this first pass might lead to distortion of viewpoints, both scientific as well as public.

S. Frishman, State of Nevada

Mr. Frishman expressed concern that earlier presenters stressed defensibility of the expert judgment process, yet they noted that such defensibility doesn't imply that the conclusions from using the process would be defensible. He supported K. Bragg's Canadian approach of not prescribing formal guidance, allowing the applicant the flexibility of developing a substantive case to support or demonstrate its conclusions. He also cautioned the tendency to used expert judgment and aggregation techniques to arrive at conclusions that are not warranted. Furthermore, he questioned the use of "insiders" in formerly elicited expert judgment, because of a tendency to galvanize pre-conceived biases. He cited the Calico Hills benefit/risk study as an example of questionable elicitation.

Mr. Frishman recalled Dr. Keeney's point that expert judgment defines the state of knowledge, not the state of nature. Mr. Frishman acknowledged that everything one can do involves implicit expert judgment, but he raised the question of the value of the formal, explicit elicitation. He indicated that formal elicitation cultivates the individual expert's opinions on how to arrive at conclusions, which would not otherwise be possible because of the lack of necessary information and/or confidence. If this is what explicit expert judgment does best, it may be advisable not to limit its use to the DOE, by being prescriptive. He was skeptical that expert judgment would be of any use at any licensing proceeding.

Mr. Frishman observed that the approach used in predicting the future states of society and human intrusion would be viewed with extreme skepticism by the public and any licensing board. He

advised that a better approach would be to view human intrusion as inevitable and to focus on the consequences thereof, as is being done in the Canadian approach. If this approach leads to undesirable results, this might be an indication that the WIPP and/or Yucca Mountain (YM) sites are not adequate candidates. He also raised the issue of natural resources near the YM site, which had been overlooked for 130 years, yet the time frame of 10,000 years should raise some concerns for future resource development activities, which present society cannot predict.

Mr. Frishman closed his remarks by remarking that in Canada, human intrusion is considered only as the compromise of the engineered barrier system (EBS), not the geologic barrier -- in the U.S. case both are considered as intrusion. He indicated that adoption of the Canadian approach may afford some additional flexibility in determining performance and compliance.

L. Abramson (NRC/RES)

Mr. Abramson made 3 observations regarding uncertainty and the use of expert judgment:

1. One uses expert judgment only in areas of significant scientific uncertainty.

2. One of the major goals of using expert judgment is to display the full range of scientific uncertainty for the decision maker -- one doesn't necessarily increase or decrease this range of uncertainty.

3. The decision maker will have to make the decision with the knowledge of the range of uncertainty -- the point is not to provide the decision maker with an easy way to set the uncertainty aside.

He cautioned the use of aggregation to hide the uncertainty from the decision maker; he observed that decision analysts sometime hide this uncertainty in order to make the decision maker's job easier or else to influence the decision by anticipating the decision maker's reaction to the judgment. Mr. Abramson mentioned the principal of regret; this consists of looking back at the decision as if it had already been made. The consequences of possible undesirable outcomes would be used to weigh the choices in order to minimize the "regret."

Round-Table Discussion

Dr. Roberds reiterated the trade-offs in selecting a panel, balancing diversity, representativeness, good qualifications, large numbers against availability, cost, conflicts, etc. He agreed with others that expert judgment should not be manufacturing data, rather it is an interpretational tool to focus the available information and data. He weighed site characterization, field data and natural analogs as more important than small lab studies. He identified the role of expert judgment as quantifying the uncertainty in interpreting all of the available information.

Ms. Trauth re-emphasized the focus on the qualitative results and understanding achieved in the WIPP Futures Panels -- not necessarily the numerical estimates.

Mr. Bragg recounted an experience in the Canadian case, where a probabilistic code using 5 or 6 thousand variables relied extensively on expert judgment -- both formal and informal. However, a sensitivity analysis identified only 4 variables that mattered. He advised the participants that cost management is essential, because there are real budget limitations, and care should be taken to properly manage resources in order to effectively arrive at program goals.

Dr. Anderson reminded the participants that the efforts in the future society-type panels are directed to try to bound the uncertainties in the non-technical conceptual models. He noted that there are many technical areas where expert panels will be used, but for WIPP it was desired to first tackle the non-technical aspects. He characterized expert panels as tools, not only to perform the investigations, but also as the mechanisms for the eventual blending of the non-technical and technical conceptual models. He also observed that if expert judgment is not the tool to use, then another mechanism will have to be "developed" to deal with the levels of uncertainty.

Mr. Wolf referred to Dr. Steindler's earlier "alternative protocol" in decision-making; i.e., using generalists rather than specialists as decision makers, careful consideration of the basis for the experts' judgments, and keeping the experts isolated from one another. Mr. Wolf thought this an outstanding protocol, because this is exactly what happens in a licensing proceeding. He advised the participants that this type of protocol with opportunity to cross-examine each other's experts would be more tuned to the ultimate objective of a licensing decision for a HLW repository.

The meeting was adjourned.

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Note: A transcript of the meeting is available at the NRC Public Document Room, Gelman Building, 2120 "L" Street, N.W., Washington, D.C. Telephone: (202) 634-3383 or can be purchased from the Ann Riley & Associates, Ltd., 1612 K Street, N.W., Washington, D.C. 20006].